GA Guide to NEXTGEN

Ric Peri
Vice President of Government & Industry Affairs
Aircraft Electronics Association

AIRCRAFT ELECTRONICS ASSOCIATION

- “The FAA’s first responsibility in operating the nation’s air traffic control system is to ensure the safe and efficient movement of planes.”

Alice M. Rivin

Director CBO (1983)

What is NEXTGEN?

- **According to the FAA:**

- **“NextGen is the transformation of how airplanes traverse the sky. It affects all of us: from the pilots that fly the planes, the passengers who enjoy the flights and the controllers who ensure the safety.”**

- **“A new era of flight.”**

What it is?

- Communication
- Navigation
- Surveillance

- “Situational Awareness”

Surveillance

- § 91.225 Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment and use.

- January 1, 2020

§ 91.225 ADS-B Out

- …. no person may operate an aircraft in Class A airspace unless the aircraft has equipment installed that--
  - (1) Meets the requirements in TSO-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz);

§ 91.225 ADS-B Out

- ….. no person may operate an aircraft below 18,000 feet MSL and in airspace described in paragraph (d) of this section unless the aircraft has equipment installed that--
  - Meets the requirements in TSO-C166b; or TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz;

ADS-B OUT Installations

- Generally require an STC.
  - Limited Field approval is the aircraft and system have been previously approved via STC.
  - Will get better.

Communication

- Terminal Data Link Services in the National Airspace System
- ** Best Equipped – Best Served
- Not considering oceanic mandates:
  - North Atlantic
  - Asia Pacific

Navigation

- Area Navigation (RNAV) is a method of navigation that permits aircraft operation on any desired flight path within the coverage of ground or space based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

- In the future, there will be an increased dependence on the use of RNAV in lieu of routes defined by ground-based navigation aids.

Navigation

- Required Navigation Performance (RNP) is RNAV with on-board navigation monitoring and alerting.

- RNP is also a statement of navigation performance necessary for operation within a defined airspace.

Navigation

- Aircraft meeting RNP criteria will have an appropriate entry including special conditions and limitations in its Aircraft Flight Manual (AFM), or supplement.

- Operators of aircraft not having specific AFM-RNP certification may be issued operational approval including special conditions and limitations for specific RNP levels.

Situational Awareness

- Flight Information Services – Broadcast (FIS-B)
- Traffic Information Service (TIS)

- Commonly referred to as ADS-B “IN”

- For reference ONLY!

Flight Information Services – Broadcast (FIS-B)

- Flight Information Services – Broadcast (FIS-B)

- weather and other aeronautical data link products for enhanced situation awareness of flight conditions.

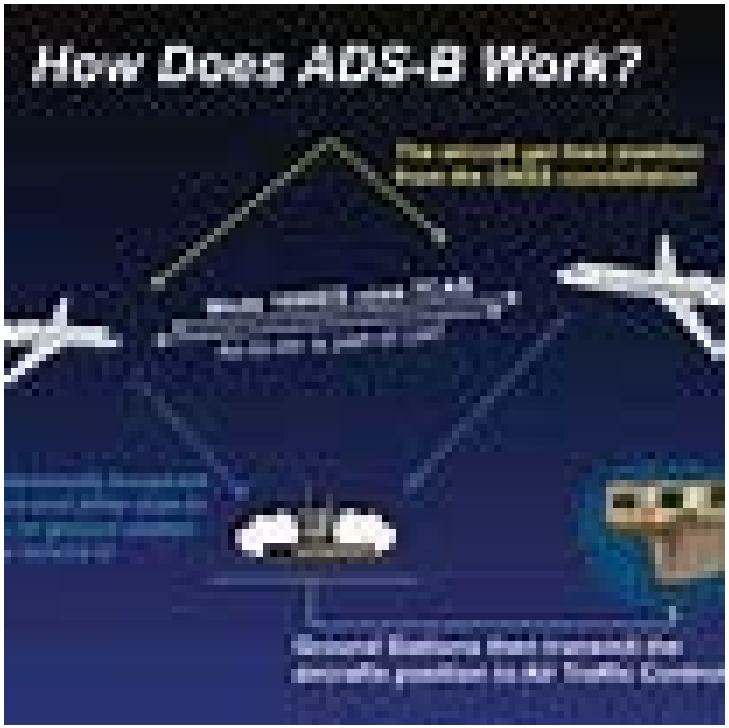
Traffic Information Service (TIS)

- The Traffic Information Service (TIS) provides information to the cockpit via data link, that is similar to VFR radar traffic advisories normally received over voice radio.

- Among the first FAA-provided data services, TIS is intended to improve the safety and efficiency of “see and avoid” flight through an automatic display that informs the pilot of nearby traffic and potential conflict situations.

NextGen Installations

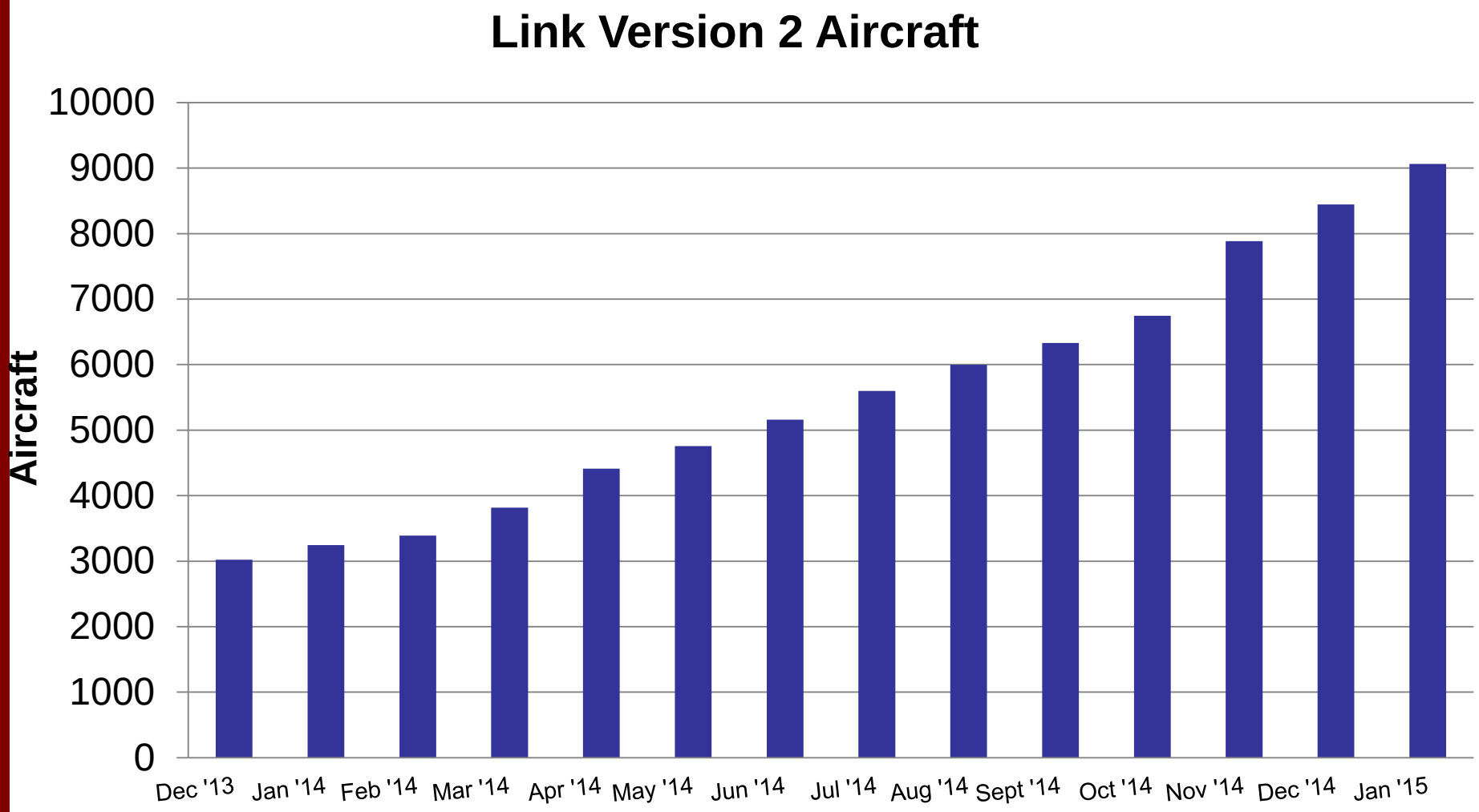
- New Era of Avionics
  - Certified to:
    - Aircraft
    - Interface
    - Software
- Integrated Systems
  - Software compatibility
- System Performance Tests
- Limited Approvals



Hot Topic

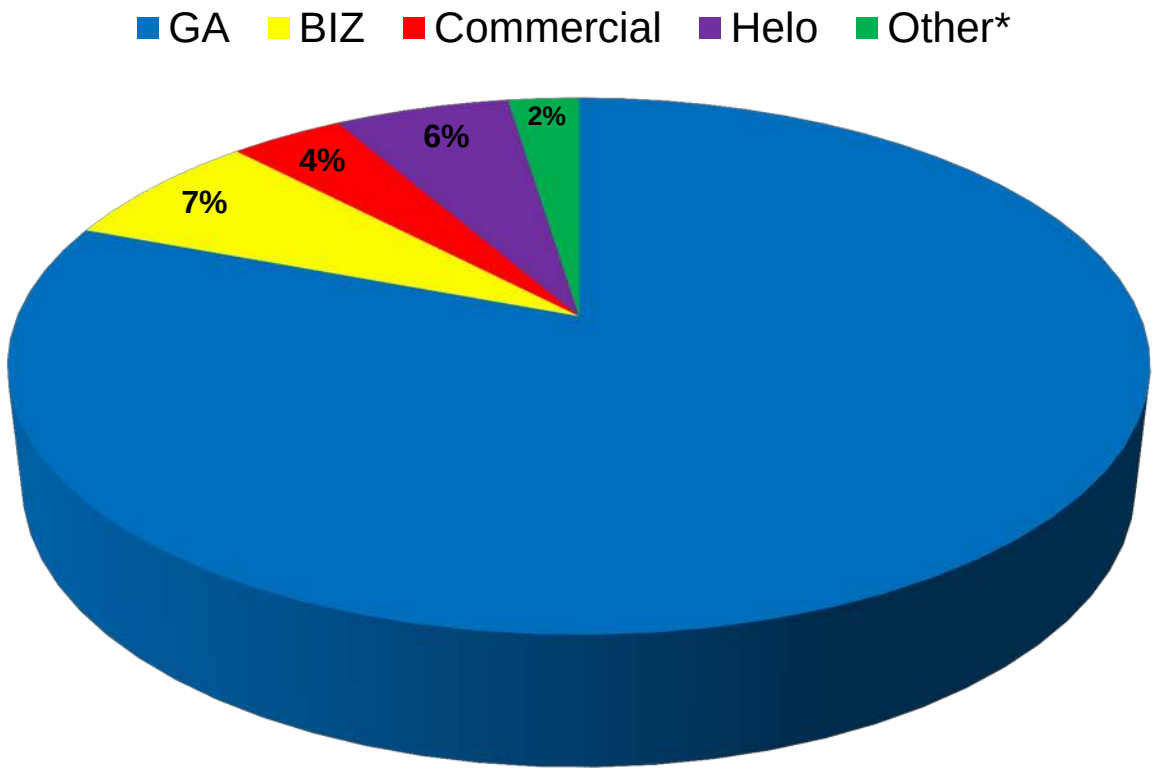
ADS-B

Equipage Update



Equipage Update

- **Approx: 9,064 US Aircraft Equipped (1/1/15)**



*Includes Balloons and Unknown Emitter Category aircraft

Equipage Update

- **Highest equipage rates by aircraft manufacturer**
  - Cessna (1304)
  - Beech (808)
  - Piper (765)
  - Vans (421)
  - Gulfstream (338)
  - Mooney (189)

Part 23 Approved V2 ADS-B Out Avionics

as of 01-Jan-2015

** multiple STC dates; only earliest shown*

Surveillance Manufacturer	Model #	Approved Position Source(s)	Aircraft	Approval Date	AML Approved
Trig-Avionics	TT-31	FreeFlight WAAS 1201 Accord Technology NexNav™ Mini Garmin GNS 400W/500W series Trig TN70	Mooney M20B-M20G, M20J & M20K	STC May 2012*	Yes
FreeFlight	FDL-978-TX	FreeFlight WAAS 1201	Agusta Westland 139 Cessna 172S	STC Jun 2012*	No Yes
Trig-Avionics	TT-22	FreeFlight WAAS 1201	King Air C-90A, Aviat/Pitts (aerobatic) S-76A/B/C (all variants)	STC Nov 2012*	No (King Air) Yes (Pitts) No (S-76x)
Garmin	GDL-88 GTX-23 GTX-33x w/ES GTX-330x GTX-3000 (GTX models require appropriate S/W rev)	Garmin GTN 625/635/650, GTN 725/750, GPS 400W, GNC 420W/420AW, GNS 430W/430AW, GPS 500W/530W (w/ or w/o TAWS) (all require appropriate S/W rev)	King Air C-90	STC Dec 2012*	Yes

Note:"N/A" indicates equipment has received TSOA, but has not received any other certification

Part 23 Approved V2 ADS-B Out Avionics

as of 01-Jan-2015

** multiple dates; only earliest shown*

Surveillance Manufacturer	Model #	Approved Position Source(s)	Aircraft	Approval Date	AML Approved
FreeFlight	FDL-1090-TX	FreeFlight WAAS 1201 (either external or integrated in FDL-978-XVR)	King Air C-90	STC Apr 2013	No
FreeFlight	FDL-978-XVR	FreeFlight WAAS 1201 (either external or integrated in FDL-978-XVR)	Bell-206 Fixed Wing	STC Feb 2014*	No Yes
Avidyne	AXP340	N/A	N/A	Feb 2014	No
BendixKing	KT-74	Accord Technology NexNav™ Mini FreeFlight WAAS 1201 GNS 400W/500W series	M20C	STC Mar 2014	Yes
Honeywell	KXP 2290A	Honeywell KGS200	PC-12/47E	EASA TC Apr 2014	Yes via Production
NavWorx	ADS600-B	Accord Technology NexNav™ Mini	Piper PA-32RT	STC Jun 2014	Yes

Note:"N/A" indicates equipment has received TSOA, but has not received any other certification

FAA-Sponsored Projects resulting in Part 23 Version 2 ADS-B Out Avionics

as of 01-Jan-2015

Surveillance Manufacturer	Model #	Planned Position Source(s)	Aircraft	Planned STC Availability	Operator
FreeFlight	FDL-978-XVR	FreeFlight WAAS 1201 (either external or integrated in FDL-978-XVR)	Various Rotorcraft models	Beginning Q4 2014	Approximately 40 rotorcraft in Alaska

Part 23 Approved Version 2 ADS-B In Avionics

** multiple dates; only earliest shown*

as of 07-Nov-2014

Manufacturer	Model #	Aircraft	STC Date	AML Approved
Garmin	GDL-88	King Air C-90	Dec 2012	Yes
NavWorx	ADS600-B	N/A	Jul 2013	No
FreeFlight	FDL-978-XVR	Bell 206 Fixed Wing	STC Feb 2014*	No Yes

Note:"N/A" indicates equipment has received TSOA, but has not received any other certification

**Airbus ATSAW (with and without ITP) received EASA approval in May 2011 as TC amendment; all A330/340s produced since Jan 2011 and all Airbus single-aisle aircraft produced since mid-2011 are ATSAW/ITP-capable

FAA-Sponsored Projects that will result in Version 2 ADS-B In Avionics

Manufacturer	Model #	Aircraft	Planned STC Availability	Operator
FreeFlight	FDL-978-XVR	Various Rotorcraft models	Beginning Q4 2014	Approximately 40 rotorcraft in Alaska

Part 25 Approved V2 ADS-B Out Avionics

as of 01-Jan-2015

** multiple STC dates; only earliest shown*

Surveillance Manufacturer	Model #	Approved Position Source(s)	Aircraft	Approval Date	AML Approved
Exelis / FreeFlight	FDL-978-TXG		VEHICLE	May 2012	Massport
ACSS	XS-950	RCI GLU-920 , RCI GLU-925 RCI GLU-920 Thales TLS8755-01-0101A/0102B RCI GPS-4000S	767, 747, A300, MD11 A320 A330 757	STC Jan 2012* STC Jul 2012 STC Aug 2012 STC Jul 2014	Yes No No No
Honeywell	XS-852	CMC CMA-4024-1 SBAS	Embraer 145, Learjet 45, Hawker 800, and Citation X	Jan 2012	No
Honeywell	ISP-80A.1	Honeywell ADIRU Part#'s HG2030BE02, BE03 or BE04	A380	EASA TC Jul 2012	Yes via Production
Garmin	GTX-330x GTX-3000 (GTX models require appropriate S/W rev)	Garmin GTN 625/635/650, GTN 725/750, GPS 400W, GNC 420W/420AW, GNS 430W/430AW, GPS 500W/530W (w/ or w/o TAWS) (all require appropriate S/W rev)	King Air C-90	STC Dec 2012*	Yes
Honeywell	XS-858B P/N 7517402-970	Honeywell GPS module (made by CMC), P/N 245-604067-100	Gulfstream 450/550	TC amendment Feb 2013	Yes via Aircraft Service Change (ASC)

Note: "N/A" indicates equipment has received TSOA, but has not received any other certification

Part 23Approved V2 ADS-B Out Avionics

as of 01-Jan-2015

** multiple dates; only earliest shown*

Surveillance Manufacturer	Model #	Approved Position Source(s)	Aircraft	Approval Date	AML Approved
Honeywell	XS-858B P/N:7017401-970	CMC GNSS/MMR, P/N 245-604067-100 Honeywell GNSS/MMR VIDL-G, P/N: 7026208-804	Falcon 2000EX/S, F900X Falcon F7X	Mar 2013* Apr 2013	No No
Rockwell	TDR-94/94D-501	N/A	N/A	Oct 2014	N/A
Rockwell	TSS-4100	N/A	N/A	Oct 2014	N/A

Note:"N/A" indicates equipment has received TSOA, but has not received any other certification

FAA-Sponsored Projects that will result in Version 2 ADS-B Out Avionics

Surveillance Manufacturer	Model #	Planned Position Source(s)	Aircraft	Planned STC Availability	Operator
Rockwell	TPR 901-205	RCI GLU 925-001 RCI GLU 925-330	737-700/800/900 (aka “737NG”)	Boeing Service Bulletin Q1 2016*	United

Boeing provided UAL with a Service Bulletin to wire 737NG for ADS-B Version 2 in 2013; UAL has wired 45 aircraft as of 28-Oct-2014 and plans to have 51 aircraft wired by 31-Dec-2014

All Boeing production aircraft have wiring provisions installed for ADS-B Version 2 as follows:

737NGs beginning with Line Number 4522 (YS115, 03-Jun-2013)
747-8 beginning with Line Number 1490 (RC510, 07-Oct-2013)
767 beginning with Line Number 1063 (VT558, 10-Oct-2013)
777 beginning with Line Number 1132 (WE166, 01-Aug-2013)

FAA-Approved Version 2 ADS-B In Avionics

as of 01-Jan-2015

** multiple dates; only earliest shown*

Manufacturer	Model #	Aircraft	STC Date	AML Approved
Honeywell	TPA-100B	B747-400	June 2011	No
Honeywell	TPA-100B	A330/340 A318/319/320/321	Dec 2011**	Yes via Production
ACSS	TCAS3000SP	A330/340 A318/319/320/321	Dec 2011**	Yes via Production
ACSS	TCAS3000SP	B767-300, A330	May 2012*	No

Note:"N/A" indicates equipment has received TSOA, but has not received any other certification

**Airbus ATSAW (with and without ITP) received EASA approval in May 2011 as TC amendment; all A330/340s produced since Jan 2011 and all Airbus single-aisle aircraft produced since mid-2011 are ATSAW/ITP-capable

AFS ADS-B Focus Team (AFT)

- **AFT Overview:**
  - Foster the consistent interpretation and application of ADS-B related regulations, policy, and guidance to support effective and efficient equipage and continuous compliance of avionics performance standards
  - Comprised of HQ SMEs from AFS, AIR and ATO
- **AFT Activities:**
  - Provide SME support to FAA field offices and aviation community during ADS-B mandate equipage
  - Coordinate resolution of issues arising during avionics installation approvals
  - Collaborate with manufacturers to address installation and avionics performance issues

Post Installation Performance Statistics

- **Approximately 20% of rule equipped aircraft do not fully comply with §91.227 equipment performance requirements**

Common Installation Issues

- Emitter Category
- Air/Ground Determination Issues
- Baro/Geo Altitude Spikes
- Missing Baro Altitude
- Duplicate or Wrong ICAOs
- Invalid/Missing Mode 3/A Codes
- Flight ID issues

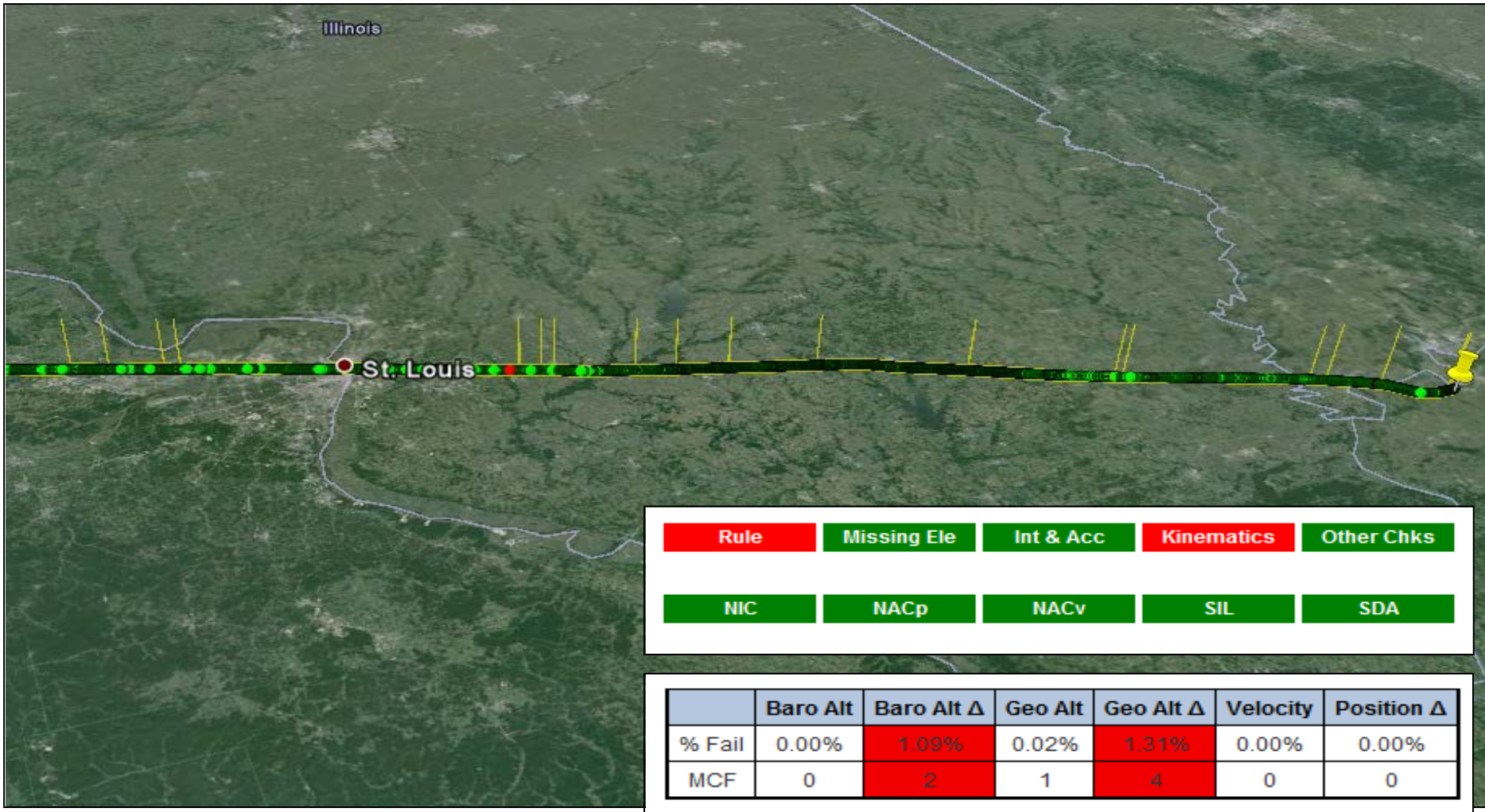
Common Installation Issues (con't.)

- **Emitter category**
  - High number of "Light" aircraft (<15,500 lbs.) are configured to transmit as "Small" (>15,500 lbs.)
  - Emitter category 6 (High Performance) is for fighters
- **Baro/Geo drop/spike**
  - No common fault identified
- **Baro Altitude not reported**
  - Barometric Altitude is always blank
  - Approximately 169 aircraft
    - 34 of 169 report fully compliant NIC/NACp/NACv/SIL/SDA

Acronym

- **NIC** Navigational Integrity Category
- **NAC_P** Navigational Accuracy Category for Position
- **NAC_V** Navigational Accuracy Category for Velocity
- **SIL** Source Integrity Level
- **SDA** System Design Assurance

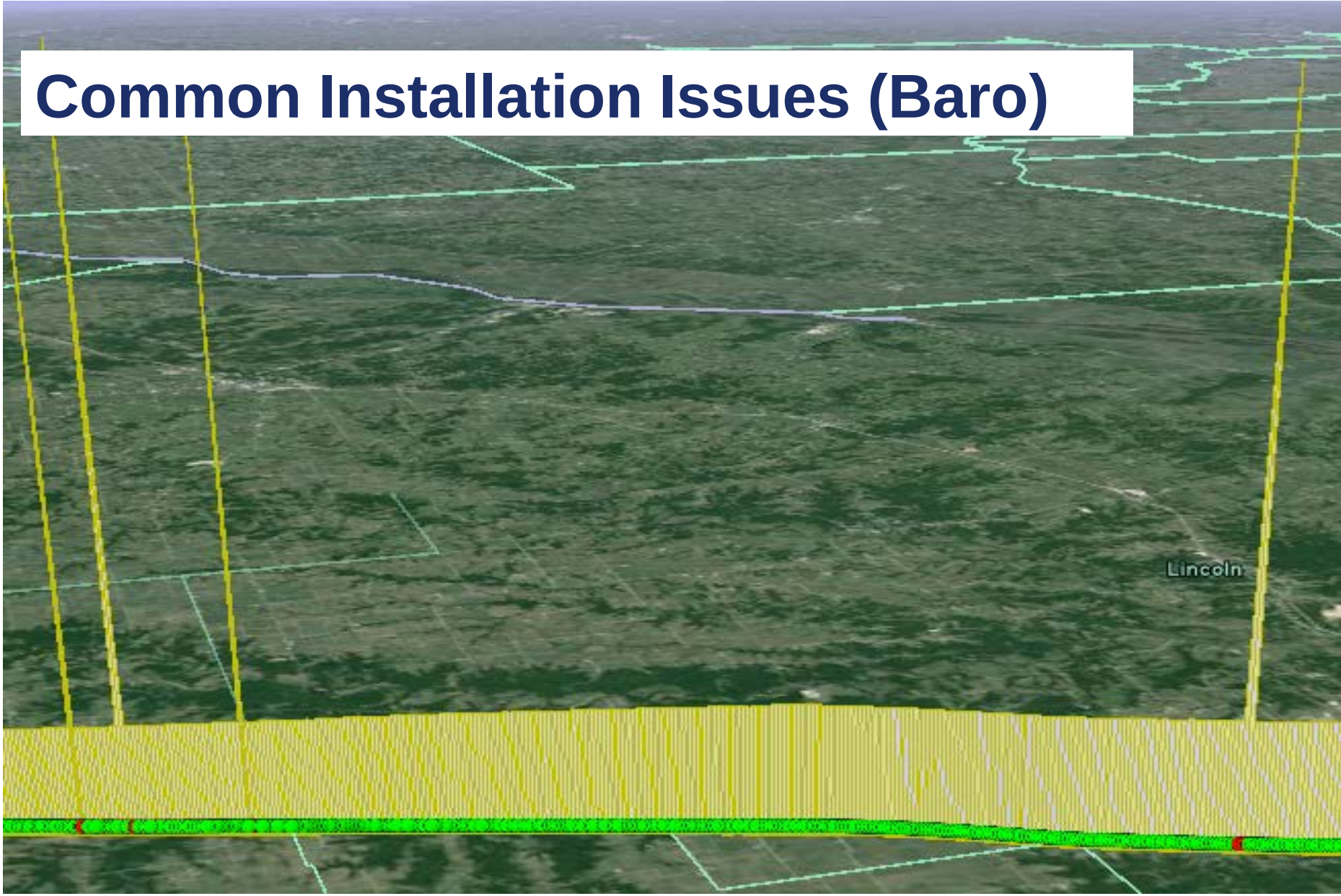
Common Installation Issues (Baro)



Rule	Missing Ele	Int & Acc	Kinematics	Other Chks
NIC	NACp	NACv	SIL	SDA

	Baro Alt	Baro Alt Δ	Geo Alt	Geo Alt Δ	Velocity	Position Δ
% Fail	0.00%	1.09%	0.02%	1.31%	0.00%	0.00%
MCF	0	2	1	4	0	0

Common Installation Issues (Baro)



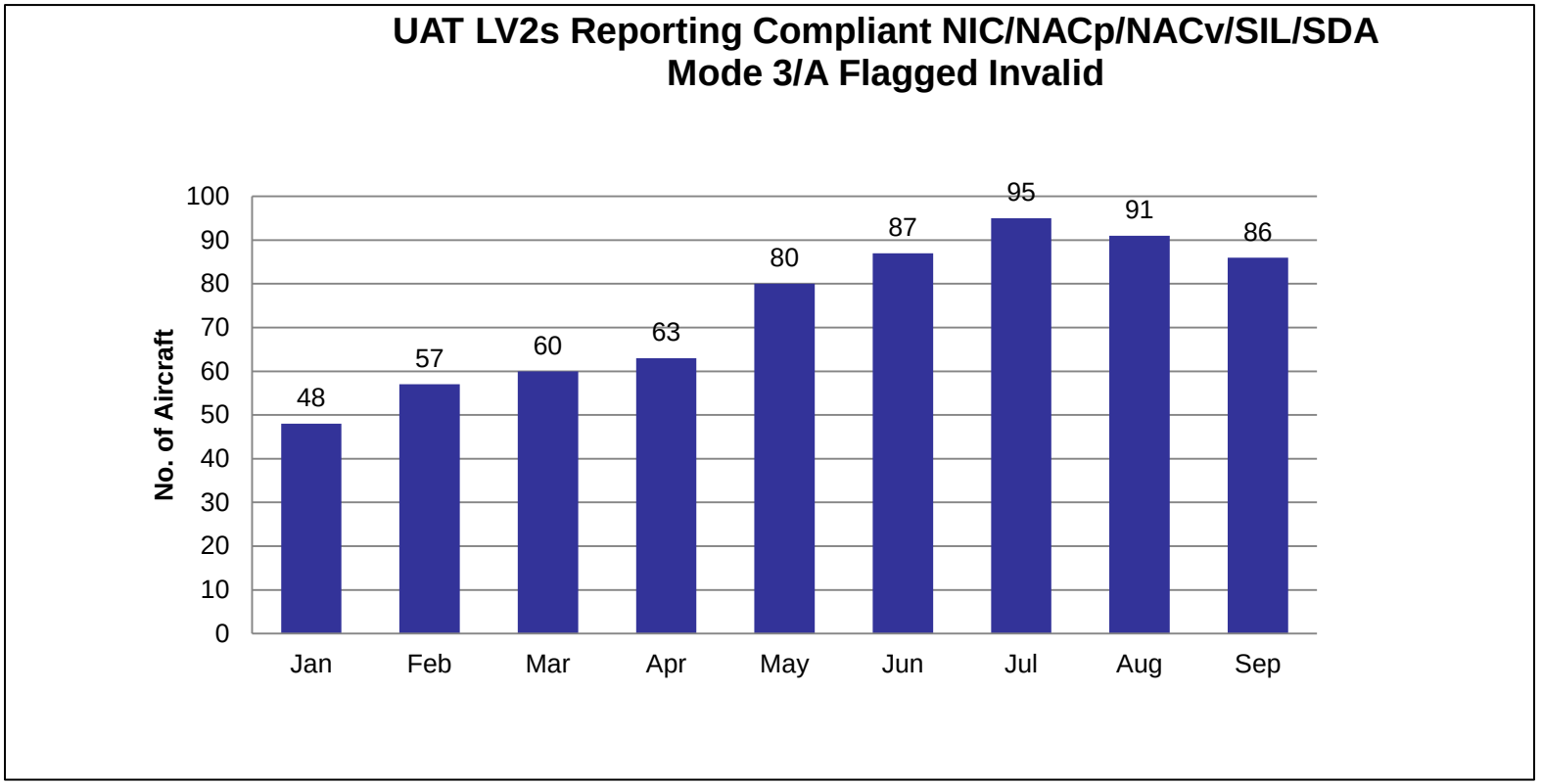
Aircraft reporting Wrong ICAO addresses

- **Multiple aircraft reporting default ICAO 24-bit addresses.**
  - A00000
  - FFFFFF
  - 123456
  - 000000
- **Others reporting wrong ICAO based on a comparison between Tail Number derived from ICAO and Flight ID**
- **AFS-360 working to identify and contact owners**

Example of a duplicate ICAO A00000

- The white lines are the Compliance Monitor tracing back and forth between the reports

Invalid/Missing Mode 3/A Codes



4.5% of LV2 UAT aircraft

AFS-360 contacting owners

Notes
No Anonymous Reports
Compliant NIC/NACp/NACv/SIL/SDA >= 99% and Valid >= 99%
No Vehicles
At least 10,000 reports

Field Approval (Policy Memo)

- **<u>Previous</u> ADS-B policy restricted approvals for ADS-B Out systems to:**
  - Type Certificate (TC)
  - Amended TC
  - Supplemental Type Certificate (STC)

Field Approval (Policy Memo)

- **<u>Current</u> policy memo allows for field approvals under specific conditions**
  - Released October 10, 2012
  - ADS-B Installation Policy Memorandum can be found on the FAA Regulatory and Guidance Website

  http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgPolicy.nsf/0/A80D6DB0C3EE5ABA86257A940057FAC8?OpenDocument&Highlight=ads-b

Field Approval (Policy Memo)

- **In order to obtain a field approval the applicant must ensure:**
  - The ADS-B Out equipment (1090ES/UAT), GNSS position sensor, and interconnect wiring are identical to previously approved design under TC, amended TC, or STC
  - The installation is performed in accordance with the equipment manufacturer's installation guidance
  - The installation is performed in accordance with AC 20-165A Chapter 3 and 4

§ 91.403 General

- (d) A person must not alter an aircraft based on a supplemental type certificate unless the owner or operator of the aircraft is the holder of the supplemental type certificate, or has written permission from the holder.

Field Approval (Policy Memo)

- **All other aspects of the installation qualify for installation under 14 CFR part 43**
- **ADS-B installation policy memo released Oct 10, 2012 supersedes all previous versions**
- **AFT working on additional guidance to support field offices with approvals**

Questions?

James Marks

Aviation Safety Inspector (Avionics)
ADS-B Focus Team Lead
Flight Standards Service, Avionics Branch (AFS-360)
james.marks@faa.gov

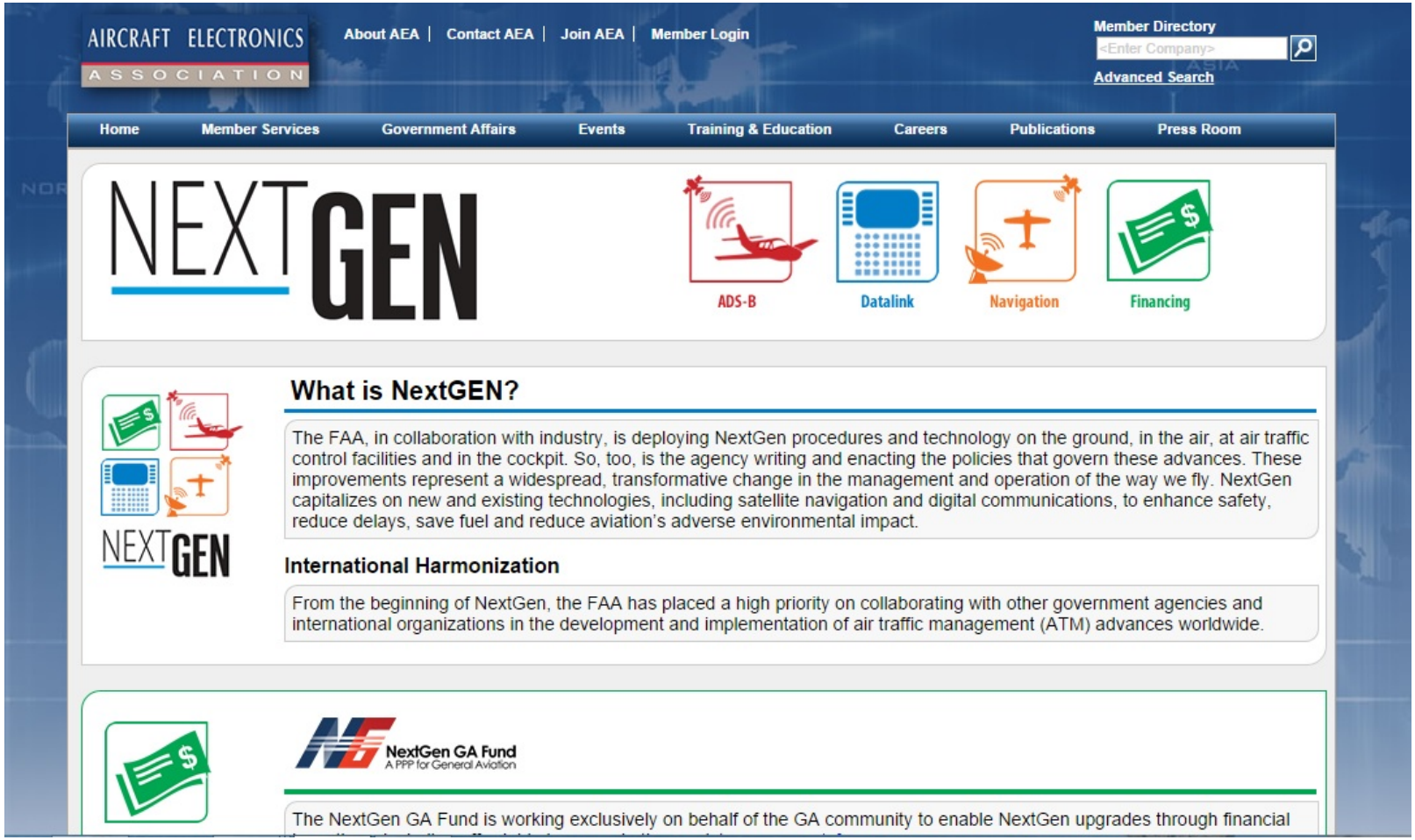
Alex Rodriguez

Aerospace Engineer
Systems and Equipment Standards Branch (AIR-132)
Alex.J.Rodriguez@faa.gov

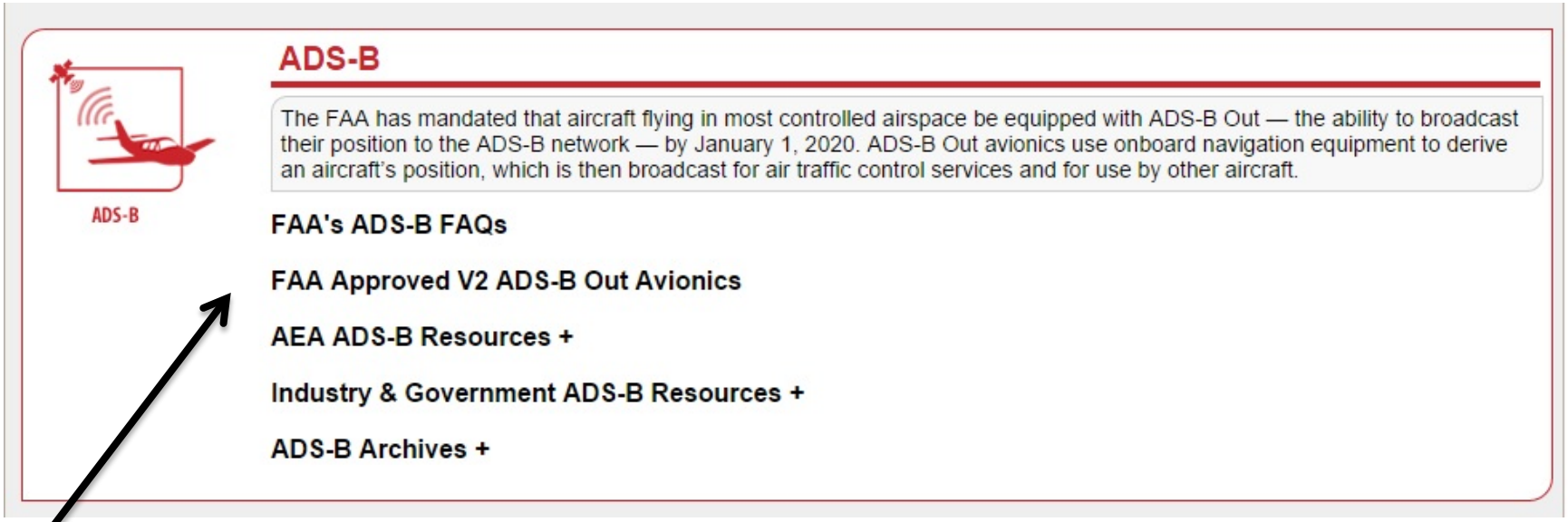
Back up slides

- **Compliance report (post installation)**
  - 9-AWA-AFS-300-ADSB-AvionicsCheck@faa.gov
- **Certification report (first of kind)**
  - 9-avs-air-130flttest@FAA.gov

www.aea.net/nextgen



Approved ADS-B “Pairs”



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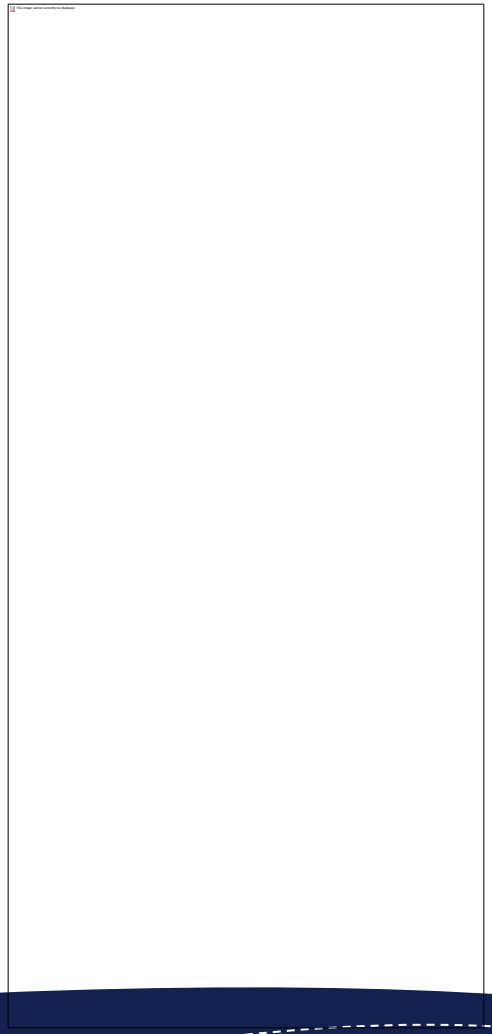
Ric Peri

Aircraft Electronics Association

ricp@aea.net
202-589-1144



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